

Cherish water &
Clean nature



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Revision 4

www.korvan.net

Cherish water & Clean nature

KORVAN

GRP Sectional Panel Water Tank



Cherish water and Clean nature **KORVAN**

● CEO Message

We are pleased to introduce ourselves as a dedicated manufacturer of GRP products in Korea. We are a front-runner in the creation of a better living environment using high technology, the newest facilities and high-quality manufacturing capabilities. Based on unsaturated polyester, we manufacture GRP sectional panel for water tank and artificial stone such as Sink top, Sink bowl, Bath tube, Ceiling panel by huge hydraulic press

Since the establishment in 1996, we have worked to develop improved living environments through continuous research and investment. Now we expand business stage to the whole Asia, the Middle East, Africa and Oceania in order to afford a high qualified products to global customers. And we will keep working to become an enterprise that creates the worldwide value of the living environment, sharing most useful products with global customers.

Always we think over our customers as we do our own family, working hard to cultivate the health and living environment-oriented business. We will grow up as a world-renowned superior enterprise, realizing the best in customer satisfaction by providing excellent products and services for the living environment, and by establishing corporate and organizational cultures suitable for the global environment.

Thank you.

Sincerely yours

Yong-Ki Lee
CEO




Headquarter

● Company history

- 1996 Apr** ▪ Established Korvan Ind. Co., Ltd
Commenced the production of Ferrovanadium
- 1998 Dec** ▪ Achieved annual sales 10 billion KRW and passed 1 million US dollars exports mark
- 2001 Apr** ▪ Established 2nd factory for Press Molding Plant
- 2002 Jan** ▪ Started the production of artificial stone for Sink-top, Sink-bowl, Table top, Bath tube, Ceiling panel
- 2003 May** ▪ Researched and developed GRP sectional panel and accessory
- 2004 Mar** ▪ Started to manufacture GRP sectional water tank
- 2007 Jan** ▪ Acquired ISO9001
- 2007 Feb** ▪ Selected as an INNO-BIZ corporation
- 2008 Feb** ▪ Contracted distributorship with Thermoset Technologies LLC for UAE market
- 2008 Apr** ▪ Established the Industry Material R&D center
- 2008 Dec** ▪ Awarded 100 million dollars export-tower by Prime Minister
- 2010 Mar** ▪ Acquired WRAS(Water Regulation Advisory Scheme) certification
- 2010 Nov** ▪ Acquired PSB Singapore certification



Export-Award Tower
(A hundred million dollars)



Main Factory



KORVAN Industry Material R&D Center

is doing its best to maximize the customer's profits through hygienic and safe product development and exhaustive quality control measures under the objective of creating living environments which global customers can enjoy together.

Approved by world best quality certification

Certificate of WRAS (Water Regulations Advisory Scheme – United Kingdom)
NO 0907543 (Sections 5120)

Korvan GRP Sectional Water Tank meet the requirements of WRAS Test of effects on Water Quality/BS6920 : 2000/ Odour and Flavour of water test : and is suitable for use with Hot and Cold water



Certificate of PSB(Productivity and Standards Board – Singapore)
Test specification SS245 as the safety for 6 times water pressure

Approved by PSB(Singapore Productivity & Standards Board) Test specification SS245 as the safety for 6 times water pressure and sanitation for potable water



PSB test for 1m x 1m x 4mH

Physical property

Korvan panel and reinforced parts confirmed by a stric quality standard

| ITEM | VALUE |
|--------------------------------|------------------|
| Tensile strength | 99.5MPa |
| Flexural Strength | 165MPa |
| Flexural Modulus of Elasticity | 13800MPa |
| Barcol Hardness | 70 |
| Absorption Rate | 0.01% |
| Glass Fiber Content | 32.1% |
| Odor & Taste | No Defects |
| Turbidity | Below 0.5 degree |
| Color | Below 1 degree |
| Light Transmission | Nil |
| Heavy Metals | Not Detected |
| Consumption of KMnO4 | 0.3mg/L |
| pH(20°C) | 6.9 |
| Phenol | Not Detected |

Certifications



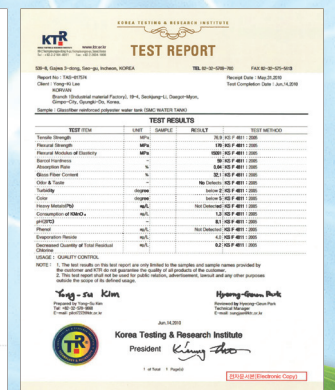
WRAS



PSB



ISO9001



KTR TEST REPORT



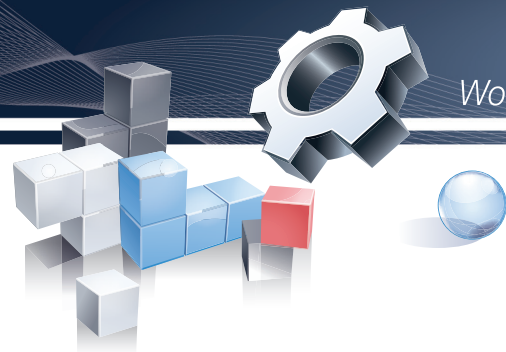
Analysis for raw material



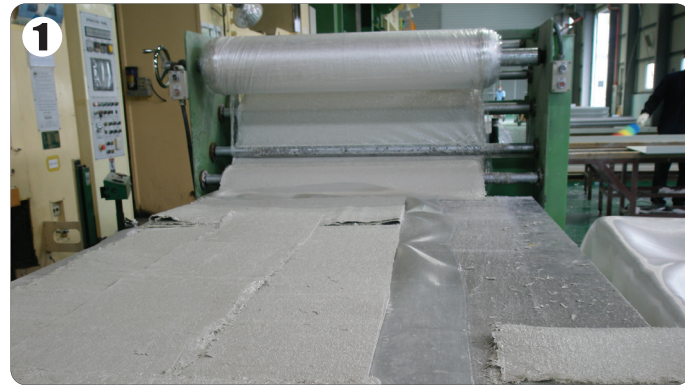
Test for Panel Transformation



Test for Hydraulic Pressure



Process of erection Korvan GRP sectional water tank



1 Cutting and measure SMC sheets



2 Molded by hot hydraulic press



3 Inspect GRP panel



4 Drill on the GRP panel



5 Concrete foundation for the erection of water tank



6 Assemble bottom panel



7 Erect wall and partition panel



8 Assemble roof panel and manhole



Delivered high quality products to global customers

It is the time for you enjoy Korvan water tank with best Quality and leading Technology.



Resort club / Korea / Size 16 x 17 x 4m/h : 1088 Ton



Labour City / UAE / Size 12 x 12.5 x 2m/h : 300 Ton



Dubai / UAE / Size 7 x 9 x 2m/h : 126 Ton



Sudan / Size 7 x 8 x 3m/h : 168Ton



Dubai / Size 7 x (5+5) x 2m/h : 140 Ton (78 Set)



Sudan / Size 9 x 25 x 4m/h : 900 Ton

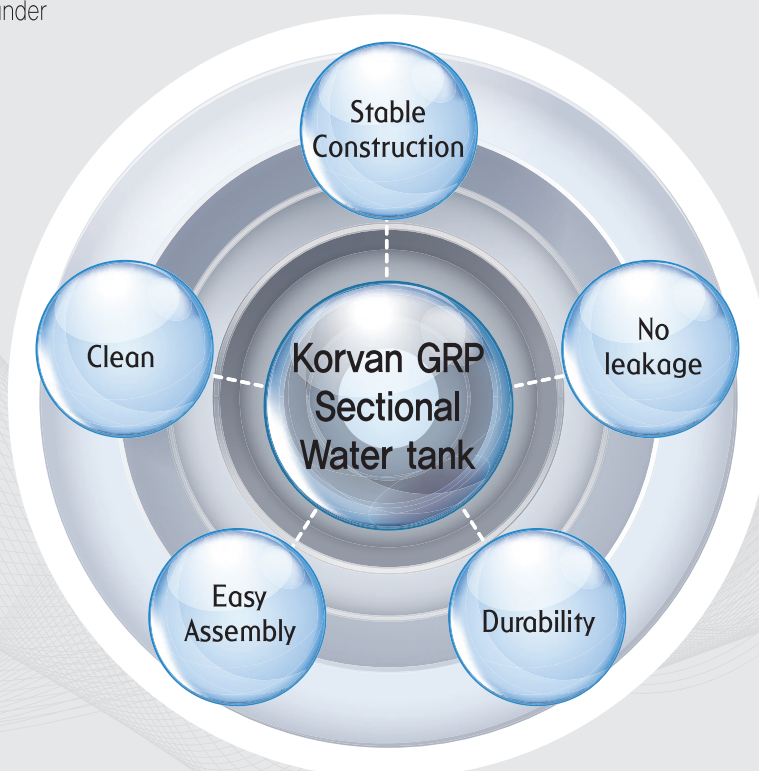


What is GRP Water Tank ?

GRP Sectional Panel Tanks are constructed of panels made from SMC(Sheet Molding Compound) by hydraulic hot press under high temperature (150°C) and pressure conditions to maintain the best endurance.

Using stainless steel for the interior structure and plated steel for the exterior, the panel exhibits excellent resistance to erosion.

Easy installation with on-site bolt assembly and Tank shape and volume can be freely designed with no restrictions based on site location, weather or climate.



COMPARISON : Korvan GRP panel type vs Other types

| | Water quality | Water tightness | Durability | Transportation | Maintenance | Anti-corrosion | Installation |
|-----------------------|---------------|-----------------|------------|----------------|-------------|----------------|--------------|
| Korvan GRP Panel tank | ◎ | ◎ | ○ | ◎ | ◎ | ◎ | ◎ |
| Concrete Tank | X | △ | △ | X | X | ◎ | △ |
| Steel Tank | △ | ◎ | ○ | △ | X | X | X |
| Stainless Steel Tank | ◎ | ◎ | ○ | △ | △ | △ | X |
| GRP Hand Lay-up tank | △ | ◎ | ○ | X | △ | ◎ | ○ |

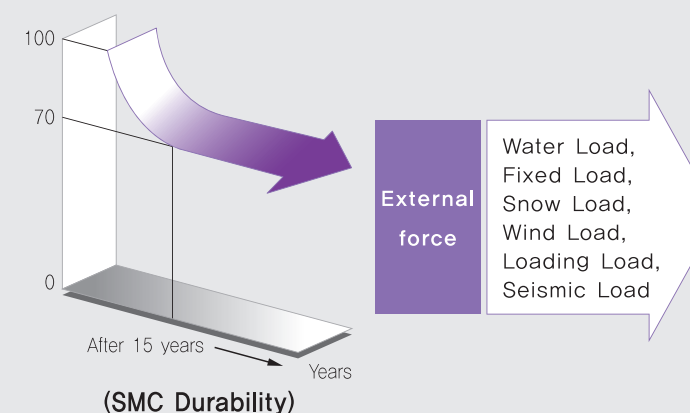
◎ : Very good ○ : Good △ : Normal X : Poor

※ It is possible that the roof panel of stainless steel tank get rust by high concentration of chlorine contents

Structural Analysis of Korvan GRP Panel

Korvan GRP water tanks are designed to be the safest panels through optimized design.

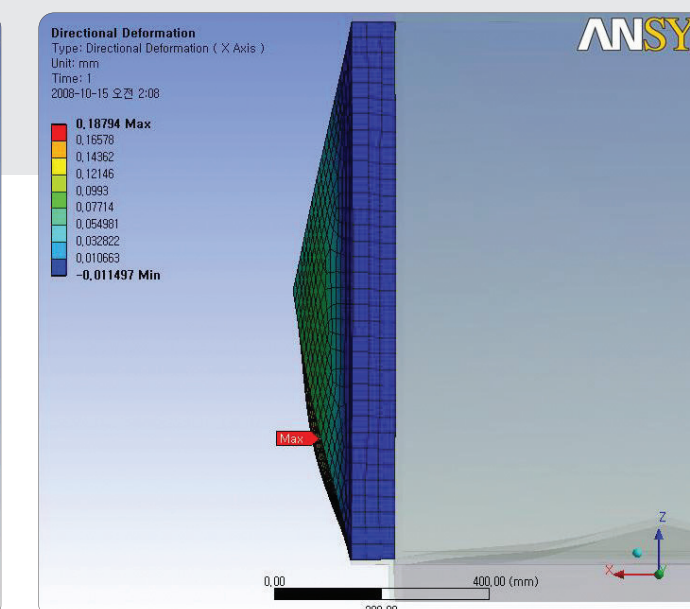
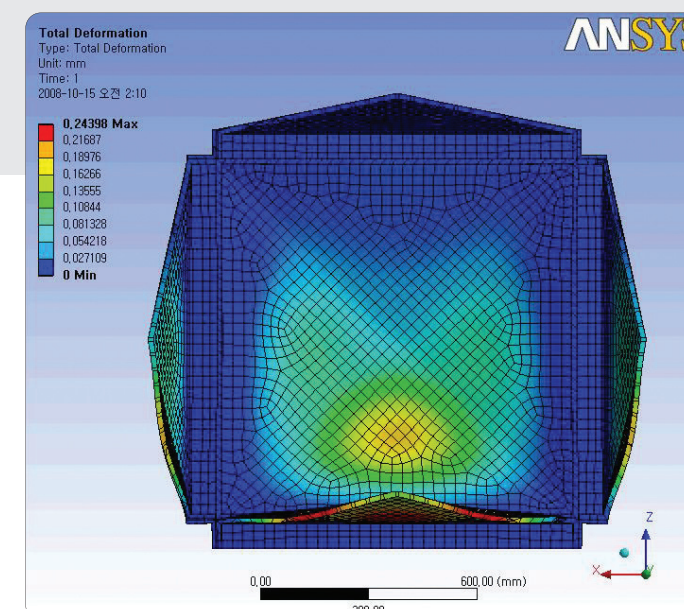
If the panels are reliable, the cost of reinforcement can be reduced and the best water tanks can be made at the most economic cost.



Design Basis : External force < Maximum feature / Safety Factor

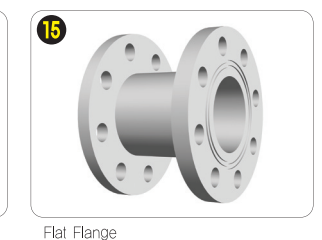
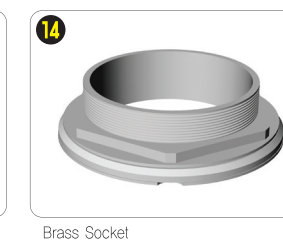
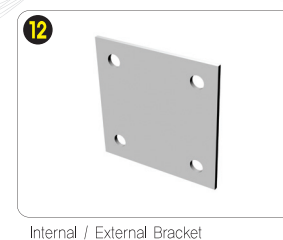
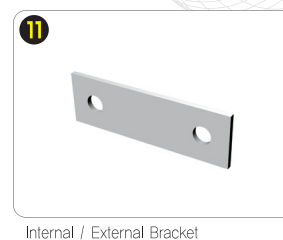
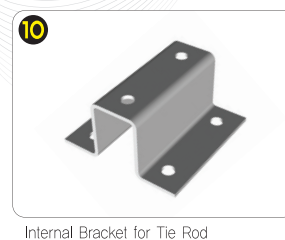
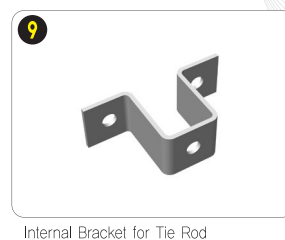
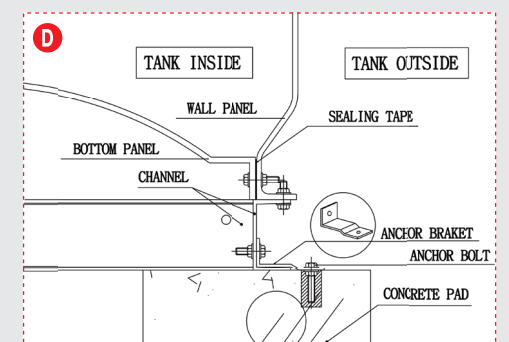
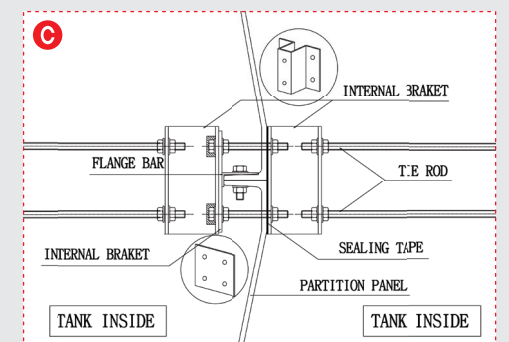
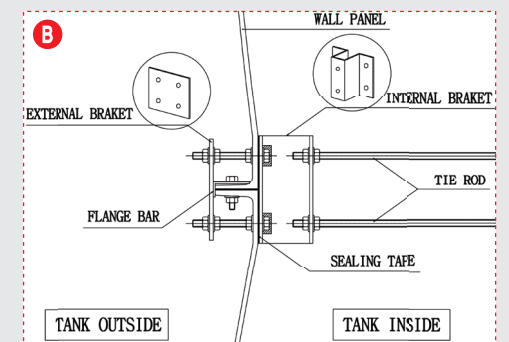
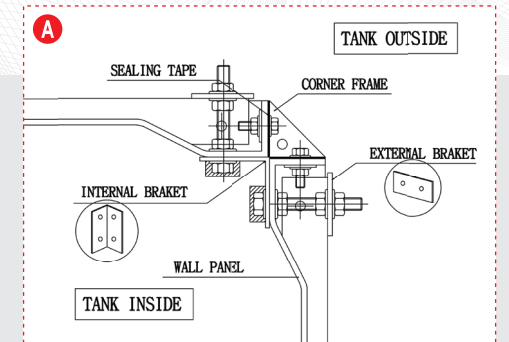
| Item | Design Condition |
|----------------------|---|
| Seismic load | horizontal Seismic $K_h = 2/3$ Vertical $K_v = 1/3$ Designed bases on $K_h = 1/3G$, horizontal seismic load. |
| Hydrostatic Pressure | Water Level [Height in Meters] $\times 0.1 \text{ KGF/cm}^2$ [0.01MPa] Designed to stand against hydrostatic pressure enough The max. change of side wall is less than 1.0% of total height left in Water for 48 hours. |
| Snow Load | 60 kgf/m^2 [at the base of 30cm of snow depth] Designed to stand under 200 kg/m^2 enough |
| Wind Load | Wind Load – 255 kgf/m^2 [2.55 $\times 10^{-3}$ Mpa] Designed to stand under max, 60m/sec even in case tank dose not include water. |
| Illumination | Illumination – Under 0.1% |
| Water Temperature | Under 30°C (normal) / Under 50°C (maximum) (Special making in case of thermal spring) |

Structural Design of wall panel (1m X1m)



GRP water tank

Internal reinforcement structure

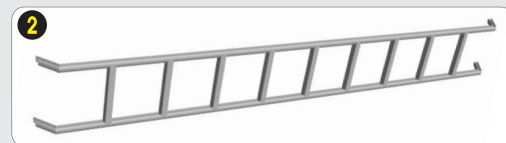


GRP water tank

External reinforcement structure



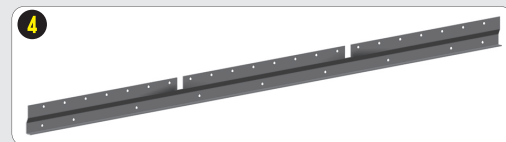
External Ladder (HDG)



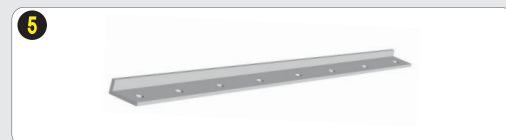
Internal Ladder (GRP)



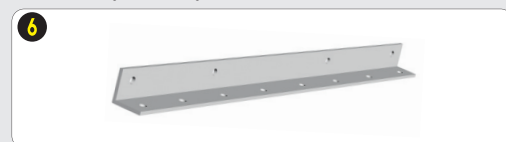
Roof Supporter (PVC)



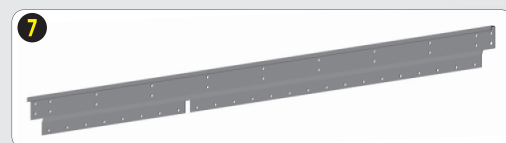
Partition Main Frame



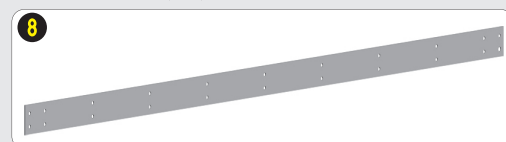
External Flange Bar - Angle (HDG)



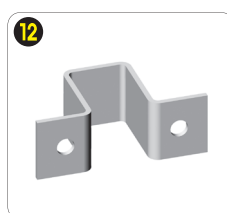
Partition Sub Frame



External Main Frame (HDG)



External Sub Frame (HDG)



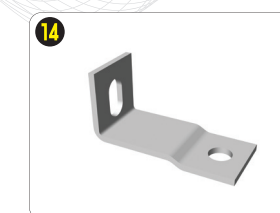
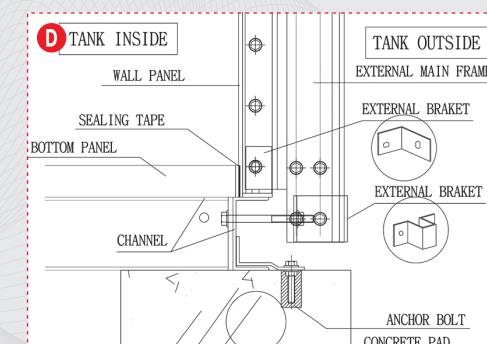
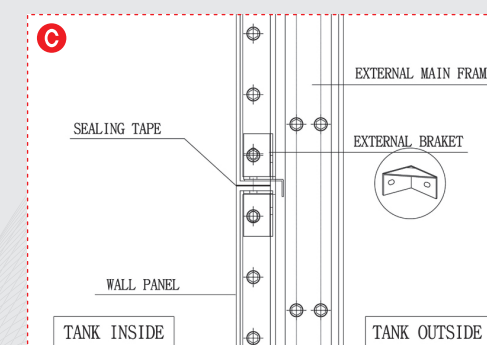
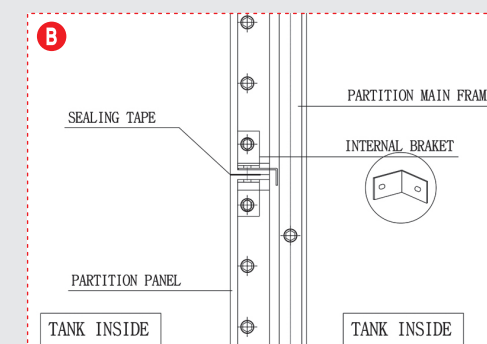
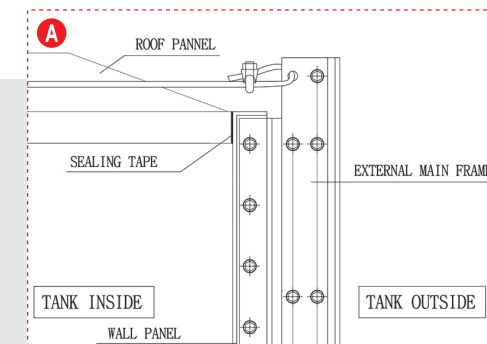
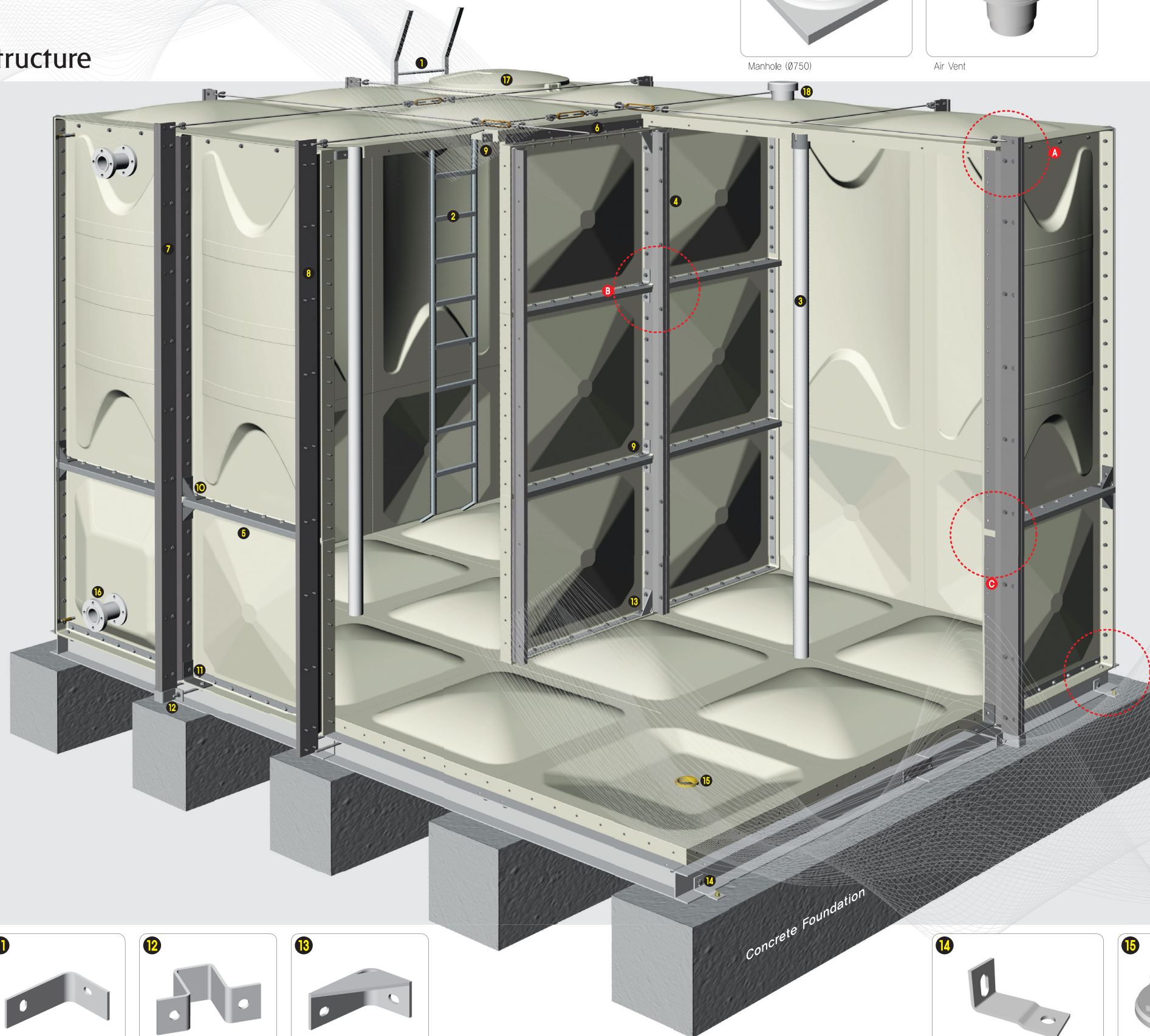
Internal / External Bracket



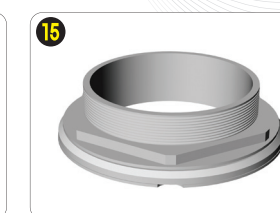
Manhole (Ø750)



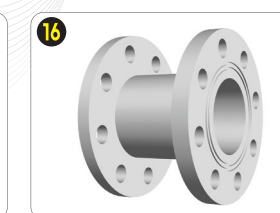
Air Vent



Anchor Bracket



Brass Socket



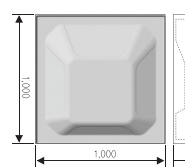
Flat Flange



GRP



Korvan produces exclusive panels and providing such as partition, manhole, flange and drain by the purpose.

Development of Exclusive
Panel for Flange in Korea.

various design for wall Panel

2,000mm
1,500mm
1,000mm
500mm

500 1,000 500 1,000 500 1,000

Features of Korvan GRP sectional water tank

Super Hygienic

Korvan panel which is certified WRAS is possible to make the GRP panels in a variety of colours.

In most cases, however, this type of tank is installed in the open, exposed to direct sunlight. If the GRP panels are translucent, the growth of algae and other micro-organisms would be accelerated.

After extensive testing and research, Korvan has adopted panel to minimize this problem, completely opaque and does not permit the passage of any light through it.

A typical problem with steel tanks has always been the high thermal conductivity and expansion of coefficient of steel. These characteristics can cause loosening of the panel connecting bolts in areas of wide temperature change



Cracked surface for Concrete water tank after 3 years installation

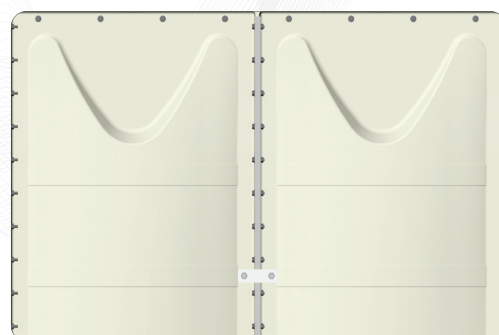


Rusted steel for STS Water tank after 3 years installation

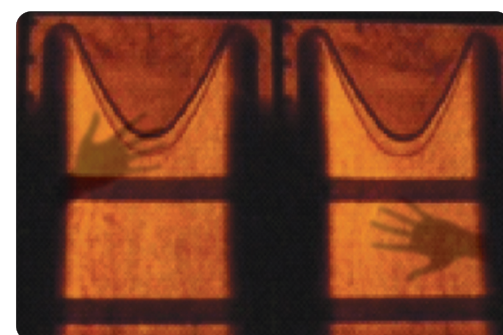


Inside state of Korvan GRP Water tank after 3 years installation

Blocked penetration of light to prevent algae growth



KORVAN panel : Prevent light penetration



Other tank : High light transmissible panel

Various design by water tank capacity

Various sized panels can make the below tanks that utilize the most horizontal & perpendicular space and also can be erected from small capacity tank to huge tank.



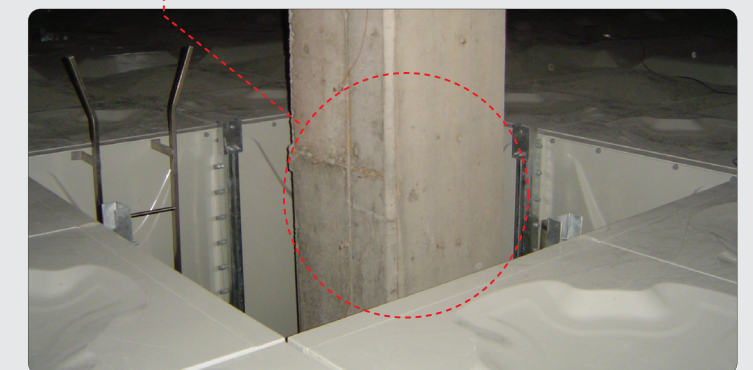
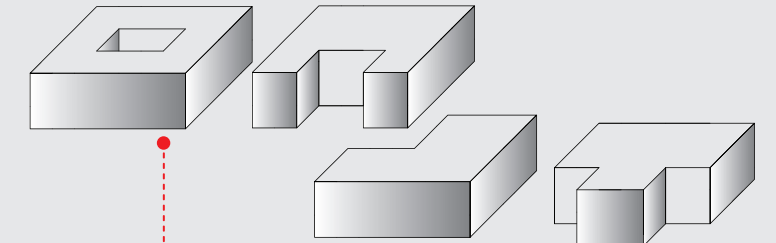
1,000 Liter for home



90,000 Liter for industry



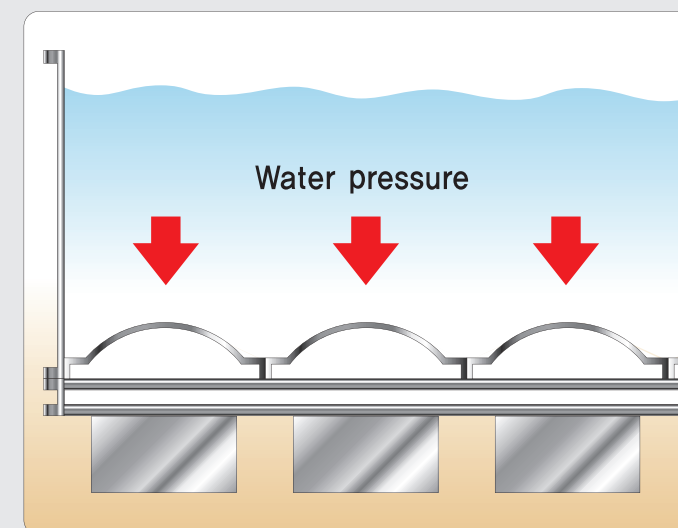
1,080,000 Liter big project



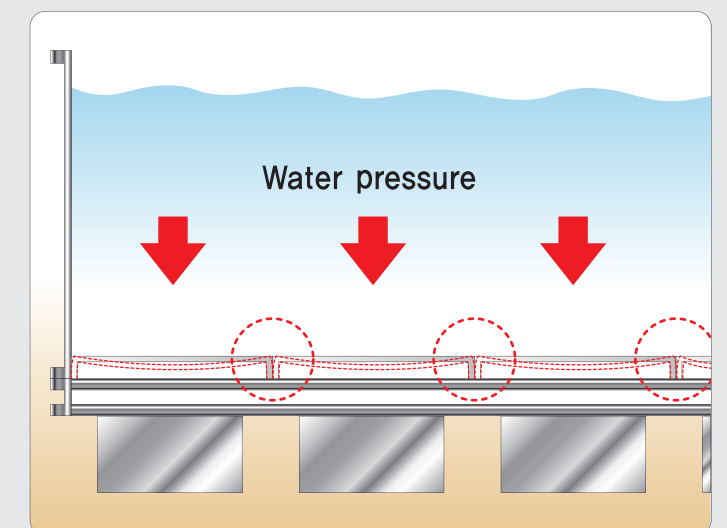
Pillar : construction of □ Type

Safety of water pressure

The convex bottom panel can be the water pressure created by filling the tank seals the joints preventing leakage. In other type tanks, water pressure can loosen the joints breaking the seal, and allowing the stored water to leak out.



Korvan convex bottom panel

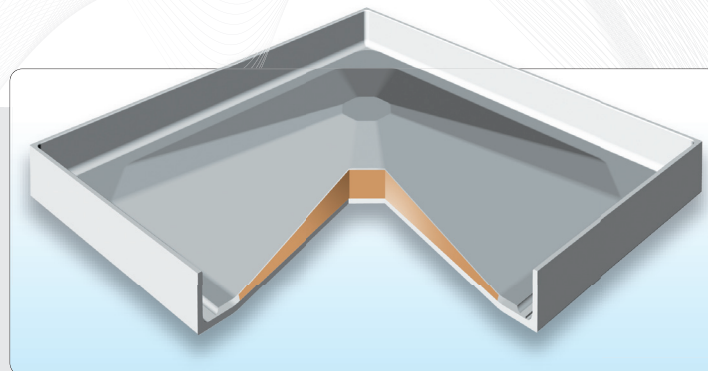


General bottom panel



Excellent Insulation

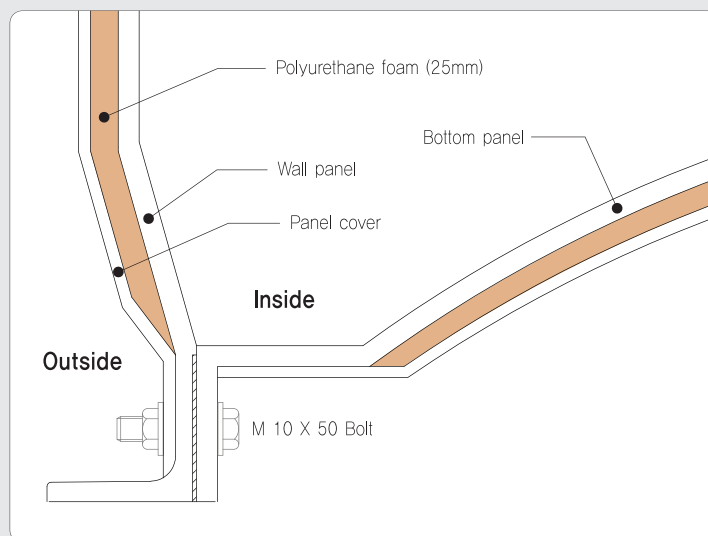
The heat insulation panel with 3 layers structure improves heat insulation effect, protects water condensation on the outside of the tank and minimizes temperature variation of the stored water.



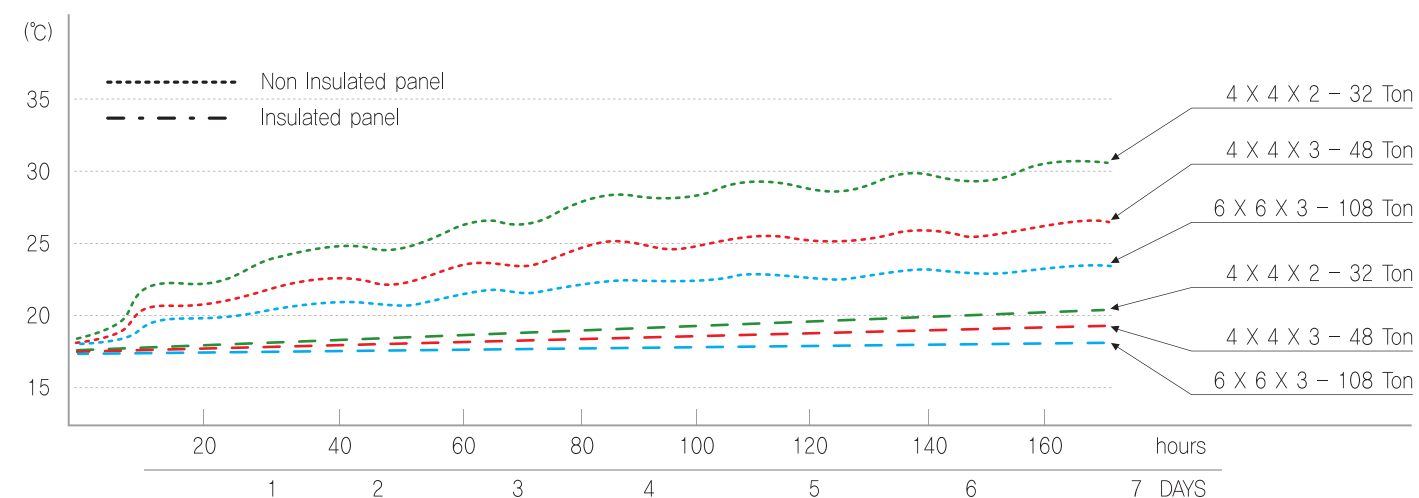
Comparison of Thermal Conductivity

| Tank type | Thermal Conductivity Kcal / m.hr°C (j / m hr°C) |
|---------------------|--|
| STEEL | 37,0 (1,55 X 100,000) |
| GRP (Non-insulated) | 0,15 (630) |
| GRP (Insulated) | 0,02 (84) |

| Tank type | Coefficient of Overall Thermal Transmission Kcal / m².hr°C (j / m² hr°C) | |
|---------------------|---|-------------------|
| | Air - Panel - Air | Water -Panel -Air |
| STEEL | 14,3 (59,9) | 24 (100) |
| GRP (Non-insulated) | 3,0 (13) | 5 (21) |
| GRP (Insulated) | 0,9 (3,8) | 1 (4) |

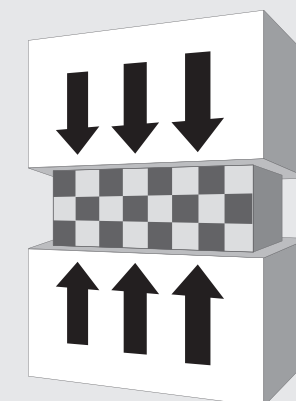
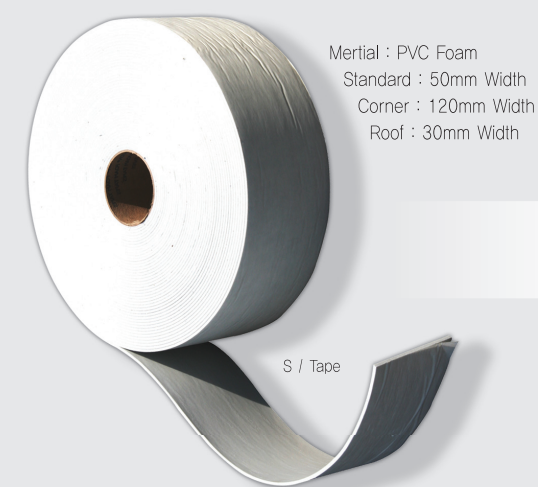


Temperature curve for inside water tank



Water Tightness

The joints are sealed with a special sealing tape for GRP sectional panel water tank with long experience and technology. It maintains soft itself and adhesives even at low temperature. The combined flange thickness at the panel joints is sufficient to meet any stress imposed. This self-sealing feature eliminates the possibility of separation and hence prevents water leakage of the tank.



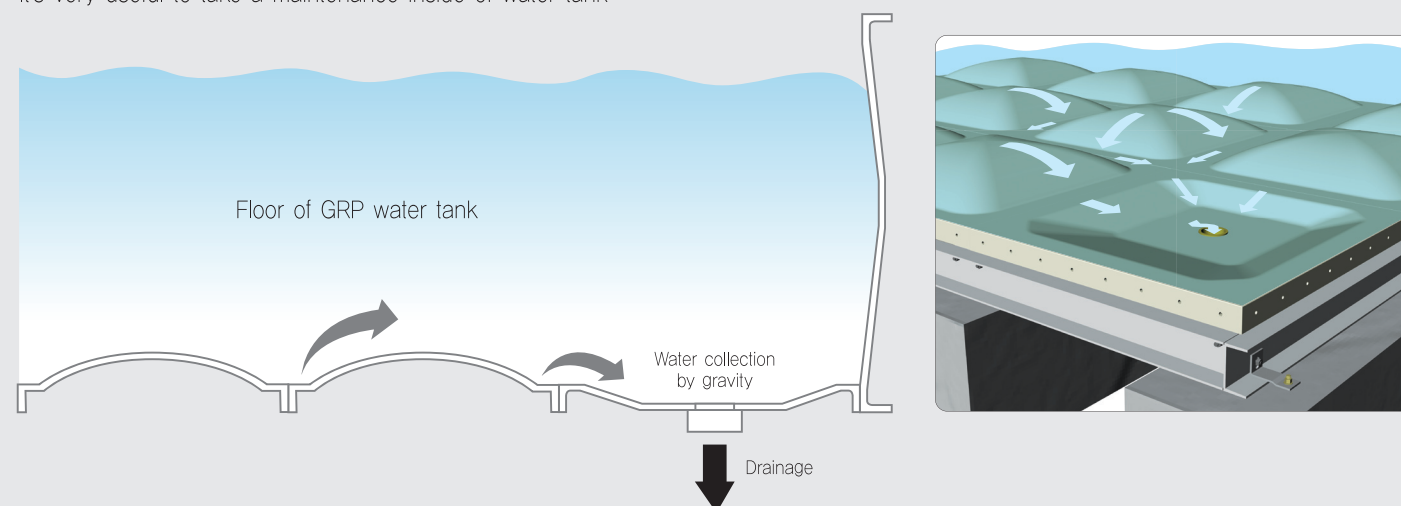
96% thickness restored initial 24 hours after compressing with sealing tapes



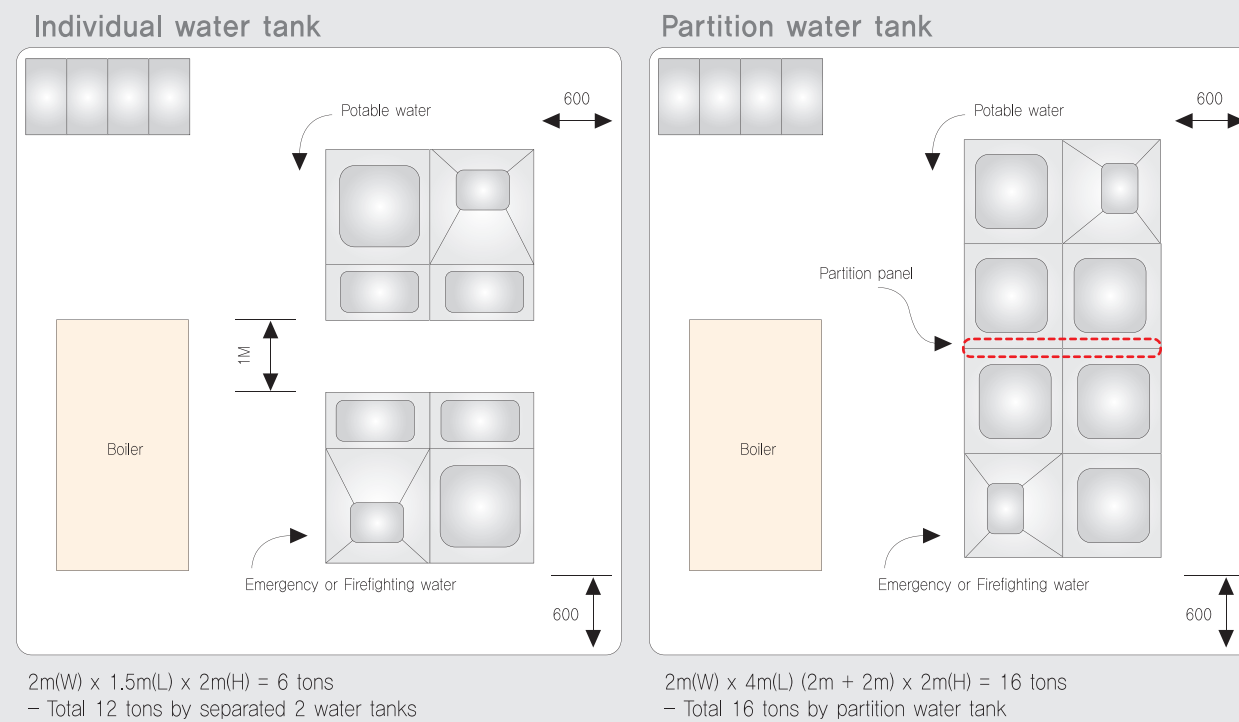
PSB test report for sealing tape

Complete Drainage

The convex bottom panels with a concave drain panel system make sure complete and fast drainage. It's very useful to take a maintenance inside of water tank.



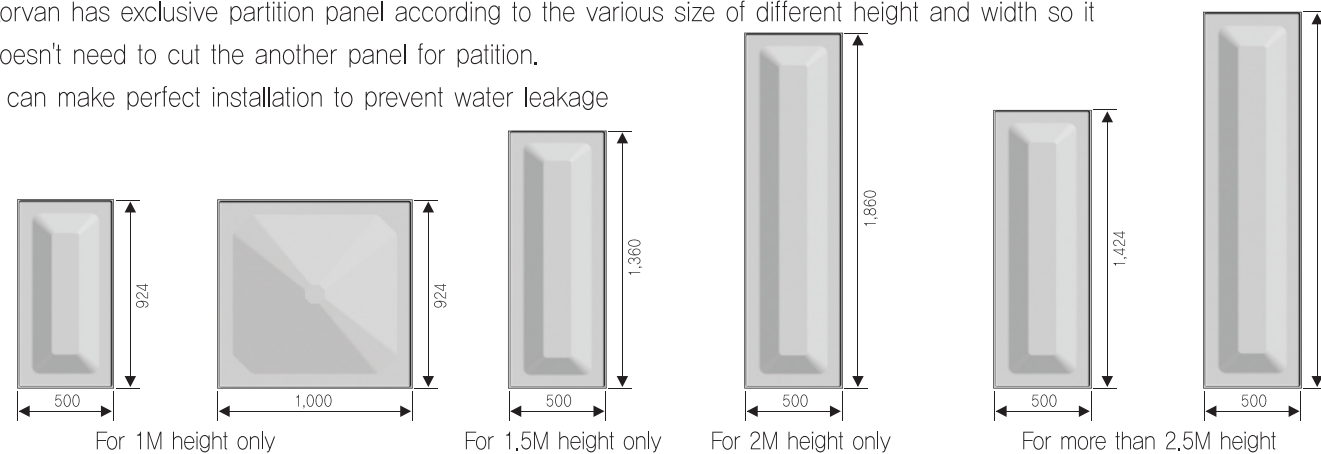
The water tank for two different purposes are needed in a confined area or boiler facility. As an example 16 tons water tank, the partition type can be divided by two tanks in one as using half(8 tons) for drinking water and another half(8 tons) for service water. If the separated water tank installed as shown on the below picture, you have to install two different tanks with a maximum each 6 tons, because you need to keep 1 meter distance between each separated tanks for maintenance and operating space.



- Various panel size for partition type water tank

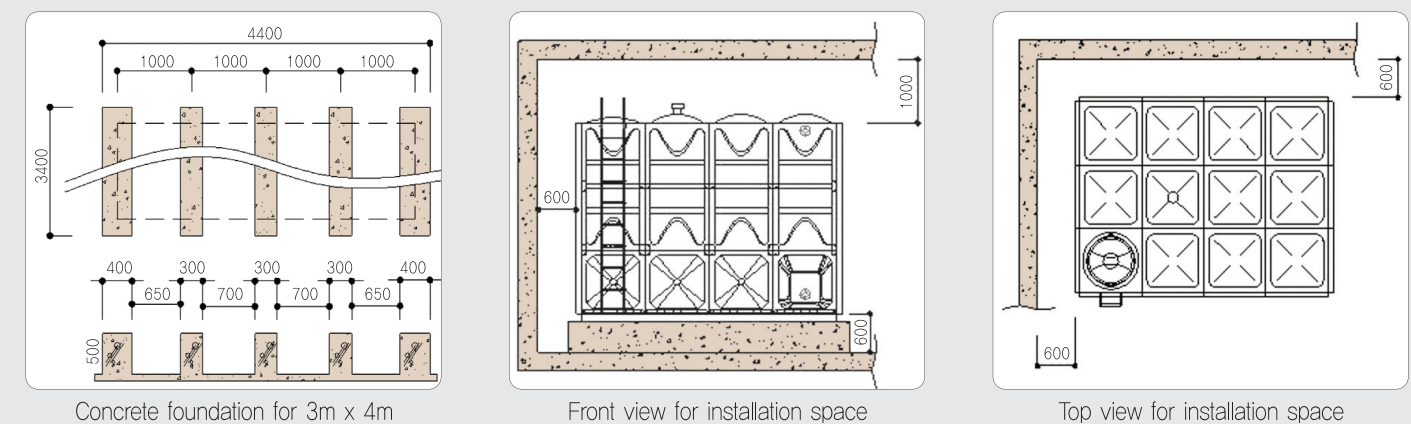
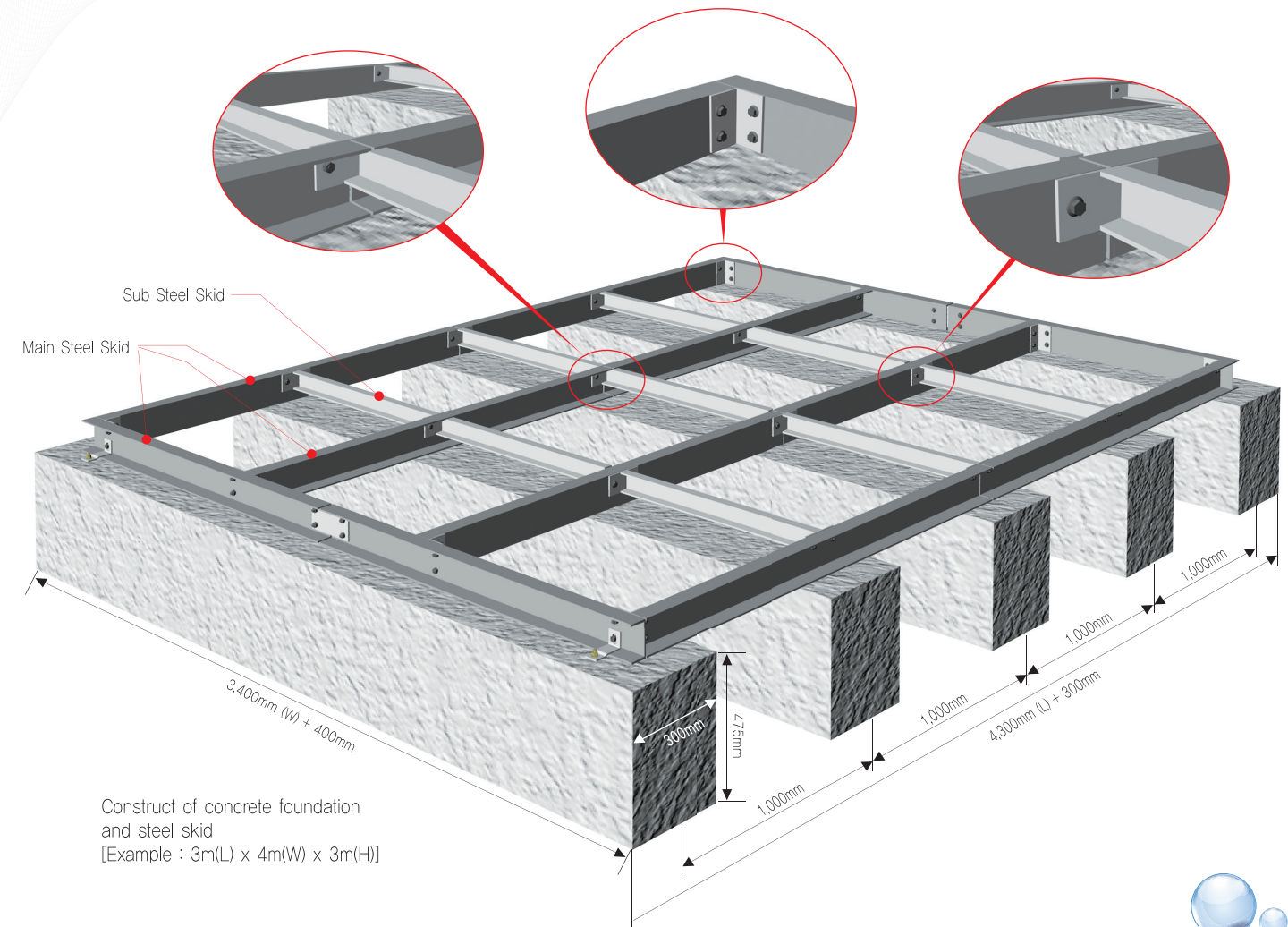
Korvan has exclusive partition panel according to the various size of different height and width so it doesn't need to cut the another panel for patition.

It can make perfect installation to prevent water leakage



Base Concrete

- Customers should construct a concrete foundation according to the designated water tank specification and the firmness of the site.
- The strength of the base concrete should be at least 180kg/cm²
- The thickness of mortar on the base concrete should be less than 20mm





Specification of steel skid

1. Durability reinforcement parts by optimized structural designed
2. Providing all accessories to able erect water tank at construction site
3. Safety construct by bolt assembly without welding and make a short construction period and reduce the cost

| Tank Height | Steel skid A (Main) | | Steel skid B (Sub) | |
|------------------|---------------------------------|---|---------------------------|---|
| Height 1m ~ 2m | angle 75 X 75 X 6mm |  | channel 75 X 40 X 3mm |  |
| Height 2.5m ~ 4m | channel 125 X 65 X 6.5 X 8mm |  | channel 75 X 40 X 6mm |  |
| Height 4.5m ~ 5m | channel 150 X 75 X 8 X 10mm |  | channel 100 X 50 X 6mm |  |

※ The above list is recommendable standard. It can be redesigned by customer's requirement and condition of construction site.

◆ Steel skid assembly by Angle type

| | Steel skid A | Steel skid B |
|------|-----------------------|-----------------------------------|
| 1M | 1140L | 990L |
| 1.5M | 1640L | 957L / 527L |
| 2M | 2140L | 957L / 1206L |
| 2.5M | 1575L / 1070R | 957L / 563L / 957L |
| 3M | 1570L / 1570R | 957L / 1063L / 957L |
| 3.5M | 1570L / 2070R | 957L / 994L / 563L / 957L |
| 4M | 2070L / 2070R | 957L / 994L / 1063L / 957L |
| 5M | 2070L / 1000L / 2070L | 957L / 994L / 1063L / 994L / 957L |

◆ Steel skid assembly by Channel type

| | Steel skid A | Steel skid B |
|------|-----------------------|-----------------------------------|
| 1M | 1120L | 990L |
| 1.5M | 1620L | 962L / 527L |
| 2M | 2120L | 962L / 1021L |
| 2.5M | 1560L / 1060R | 962L / 553L / 962L |
| 3M | 1560L / 1560R | 962L / 1053L / 962L |
| 3.5M | 1560L / 2060R | 962L / 994L / 553L / 962L |
| 4M | 2060L / 2060R | 962L / 994L / 1053L / 962L |
| 5M | 2060L / 1000L / 2060L | 962L / 994L / 1053L / 994L / 962L |

Specification of connection

1. Specification of connection

- Able to supply all installation accessories including connection by customer's requirement
- Customer should inform the specification of inlet, outlet, drain and overflow size.
- The below list is for Korvan standard connection for customer's reference

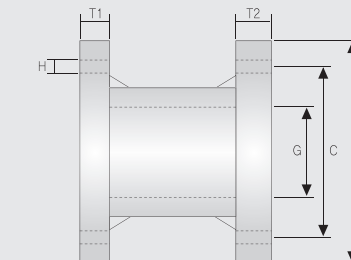
Standard Connection Size

| Water tank capacity(m³) | Inlet | Outlet | Overflow | Drain |
|-------------------------|-------|--------|----------|-------|
| 1m³ ~ 10m³ | 25A | 50A | 50A | 25A |
| 11m³ ~ 20m³ | 40A | 50A | 50A | 40A |
| 21m³ ~ 50m³ | 50A | 65A | 65A | 40A |
| 51m³ ~ 100m³ | 65A | 80A | 80A | 50A |
| 101m³ ~ 200m³ | 80A | 100A | 100A | 50A |
| 201m³ ~ 500m³ | 100A | 125A | 125A | 80A |
| 501m³ ~ | 125A | 150A | 150A | 80A |

2. Connection line-up

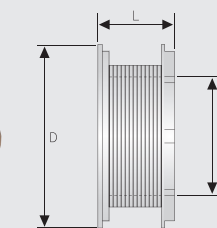
◆ Flange Type (PVC)

| mm / inch | D | T1 | T2 | G | L | C | Hole |
|-----------|-----|----|----|-----|-----|-----|------|
| 65A (2½) | 175 | 20 | 25 | 77 | 140 | 140 | 4 |
| 80A (3) | 185 | 20 | 25 | 90 | 140 | 150 | 8 |
| 100A (4) | 210 | 20 | 25 | 115 | 140 | 175 | 8 |
| 125A (5) | 250 | 20 | 25 | 140 | 140 | 210 | 8 |
| 150A (6) | 280 | 20 | 25 | 170 | 140 | 240 | 8 |
| 200A (8) | 330 | 22 | 25 | 220 | 150 | 290 | 12 |
| 250A (10) | 400 | 24 | 25 | 270 | 170 | 355 | 12 |
| 300A (12) | 445 | 24 | 25 | 320 | 170 | 400 | 16 |



◆ Socket Type (Brass)

| mm / inch | D | D1 | L | T |
|-----------|-----|----|----|-----|
| 15A | 43 | 19 | 26 | 1.5 |
| 20A | 46 | 25 | 30 | 1.5 |
| 25A (1) | 53 | 31 | 32 | 1.5 |
| 32A (1½) | 66 | 39 | 35 | 1.5 |
| 40A (1½) | 73 | 45 | 36 | 1.5 |
| 50A (2) | 85 | 57 | 40 | 1.5 |
| 65A (2½) | 111 | 72 | 46 | 2 |



Caution for the connection

Install a prop while installing piping and take care not to put an excessive load
Install pipes on the site where the tank is located and take care not to put on the biased load